A Review on Smart Specs

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ABSTRACT

The recent study highlights the critical issue of driver drowsiness, a leading cause of road accidents resulting from fatigue. A system capable of detecting drowsiness and warning drivers at an early stage could significantly reduce the number of drowsiness-related road accidents. Drowsiness refers to a state of being sleepy or having a compelling desire to fall asleep. It is often characterized by reduced alertness, slowness, and difficulty staying awake or maintaining focus. This paper presents a literature review of driver drowsiness detection systems based on the analysis of physiological signals, facial features, driving patterns, and steering wheel monitoring. "Smart glasses," which utilize an eye blink sensor and Arduino, monitor the driver's eye movements and trigger a warning using vibrations and a loud buzzer if the driver begins to doze off.

Keywords:- : Facial features ,Eye Blink sensor, Arduino ,Vibration sensor,

INTRODUCTION

Driver drowsiness is a primary cause of road accidents, with fatigue from long driving hours being a key contributing factor. Various countries report driver fatigue as a major contributor to accidents, with a significant number occurring in India in 2022. In our day-to-day lives, transportation systems play an important role in human activities. Anyone can become a victim of road accidents at any time for various reasons, but most accidents are caused by driver drowsiness. The main causes of drowsiness include a lack of rest and sleep, which lead to tiredness during long journeys. These factors reduce driver vigilance, resulting in serious situations and increasing the likelihood of accidents. For this reason, a significant number of accidents occur globally each year.[6]

Smart spectacles (smart specs) are innovative wearable devices designed to enhance driver safety by monitoring signs of fatigue and drowsiness in real time. With the increasing prevalence of road accidents caused by drowsy driving, these devices offer a promising solution to mitigate risks and improve road safety. Equipped with advanced sensors and integrated technologies, smart specs can detect physiological and behavioural cues, such as eye closure, blinking patterns, and head movements, which are indicative of fatigue. Smart specs designed for driver drowsiness detection represent a significant advancement in vehicular safety technology. By combining sensors and real-time data analytics, these systems enhance road safety and minimize the risks associated with driver fatigue.

LITERATURE REVIEW

Enhanced Driver Drowsiness Detection using Deep Learning – Dipender Singh , Avtar Singh (2023) [1]

This paper focuses on how modern technologies like distributed pressure sensors, eye-tracking cameras, and wearable devices can help solve this problem. It emphasizes the importance of choosing vehicle sensors that ensure driver safety, comfort, and reliability, even in cases of false readings or system failures.

The paper discusses advanced vehicle automation systems that use the CAN protocol for real-time and reliable communication. It highlights solutions that combine facial and eye feature detection through cameras that monitor blinking and measure eye closure duration. At the same time, it analyses hand pressure on the steering wheel using Arduino and elastomeric sensors. These inputs are processed together to detect driver drowsiness and trigger alerts to prevent accidents. The paper explains the design and implementation of this system.

Drowsiness Detection System in Real Time Based on Behavioural Characteristics of Driver using Machine Learning Approach- Gauri Adarsh , Vineet Singh , Dr Shikha Singh , Dr Bramah Hazela (2023) [2]

This paper works explore and find different methods of observing the early warning signs for driver drowsiness. Some use physiological signals such as EEG and ECG and computer vision systems which find head position, face and eye movements. Other studies make use of behaviour analysis of patterns to determine driver drowsiness.

Several studies have been performed to classify and analyse the existing methods of driver drowsiness detection, such as based on behavioural, vehicular, and physiological parameters techniques. Some projects have developed systems that can distinguish and alert the driver about his drowsiness and prevent accidents while driving. Some real-time face-based driver-drowsiness detection system has also proposed, such as DiCare, which achieves 92% accuracy.

Besides machine learning algorithms, image processing-based approaches have been proposed for driver drowsiness detection. Some comparative analysis has been provided to help select the best suitable technique for needs. Deep learning-based systems have exhibited good results wherein the OpenCV environment of Raspberry Pi displays 96% accuracy for the real-time input video.

SLEEP ALERT GLASSES A DRIVER DROWSINESS DETECTION AND ALERTING SYSTEM - Mrs. S. Vijayalakshmi, K. R. Manjaarika, M. Shruthi (05/May-2023) [3]

The paper introduce the “Sleep Alert Glasses,” a drowsiness detection and alerting system designed to stop accidents occurring because of drowsy driving. The system employs an Eye Blink sensor and Arduino microcontroller to observe the driver’s eye movements, simulating an alert through vibrations and a buzzer if drowsiness is spotted. Drowsy driving is a International problem , resulting in countless accidents and fatalities, with existing solutions often falling short, especially for smaller vehicles like bikes. The recommended eyewear are lightweight, user-friendly, and effective across various driving conditions, making them ideal for severe risk drivers. The design process involved iterative research and user feedback, enhancing the reliability and functionality of the glasses. Future enhancements may include machine learning integration for improved accuracy in drowsiness detection.

A Review of Recent Developments in Driver Drowsiness Detection system – Yaman Albadawi , Maen Takruri , Mohammed Awad (2022) [4]

This paper focuses on systems utilize various inputs such as facial features, eye movements, head positioning, heart rate, and driving behaviour to assess a driver's alertness. Traditional approaches rely on visual data from cameras to track eye closures and yawning, while emerging methods incorporate wearable devices and in-vehicle sensors for physiological monitoring. Machine learning models enhance accuracy by analysing patterns and real-time data to predict drowsiness levels. Additionally, advancements in edge computing and real-time processing enable seamless integration into vehicles. Despite these improvements, challenges such as individual variability, environmental factors, and cost-effective implementation remain. Ongoing research focuses on addressing these issues to create robust, reliable, and accessible drowsiness detection systems for widespread adoption.

Driver Drowsiness Detection and Alert System Swapnil Titare ,Shubham Chinchghare, K. N. Hande (21 June 2021) [5]

This research project aims to curb accidents due to driver fatigue with the development of a drowsiness detection system. The system captures live webcam feeds to analyse images taken of the driver using machine learning techniques, primarily eye and face extraction with Dlib. It triggers a buzzer alarm with increasing intensity as the driver shows no response. The system continues sending alerts in the form of SMS and emails to the family of the driver. The safety project has been aimed at reducing accidents through improvements in real-time monitoring and responses of the drivers.

This project deals with the very critical issue of drowsy driving, one of the most significant causes of road accidents, by developing a driver drowsiness detection system. Utilizing a webcam, the system applies image processing techniques with OpenCV and Dlib libraries for facial landmark tracking, especially eye landmarks, to identify signs of drowsiness. Key algorithms used are EAR (Eye Aspect Ratio), Haar Cascade, LBPH, and neural networks.

Driver Drowsiness Detection- K.Satish, A.Lalitesh, K. Bhargavi, M.Sishir Prem and Anjali.T 28July (2020) [6]

Drowsiness is the major cause of road accidents globally, causing numerous fatalities and injuries. This research paper presents a novel model for detecting driver drowsiness and strive to ensure transportation safety. The model leverage two detection methods: analysing the driver’s facial features and eye blinking rates using a camera, and examining hand pressure measurement on the steering wheel through an Arduino module integrated with elastomeric

sensors.. It incorporate both hardware and software component for optimal performance ,the hardware component utilizes Arduino microcontroller and load cell sensors for detecting driver activity and software tool employs OpenCV and HOG (*Histogram Oriented Gradient*) algorithm for real time facial and eye detection. The detection mechanism integrate both visual and pressure to establish threshold values for determining drowsiness , triggering alerts if necessary .The study emphasizes the importance of integrating advanced technologies, such as sensors and cameras, to improve driver attentiveness and reduce accident threat.

A Portable Fuzzy Driver Drowsiness Estimation System- Alimed Celecia , Karla Figueiredo , Marley Vellasco and René González (23 July 2020) [7]

The automatic detection of driver fatigue is important for preventing traffic accidents. Effective devices must be portable, adaptable to various drivers and vehicles, and resilient to challenges like illumination changes and visual occlusions. This study develops a portable, low-cost, and accurate drowsiness detection system by leveraging powerful embedded systems like the Raspberry Pi. The real-time drowsiness detection device uses a fuzzy inference system to combine some complementary measures of eye (PERCLOS, ECD) and mouth (AOT) states within a temporal window, categorizing drowsiness into three levels: Low-Normal, Medium-Drowsy, and High-Severe, achieving 95.5% accuracy, thus proving its feasibility and effectiveness.

Real-time Driver Drowsiness Detection for Android Application Using Deep Neural Networks Techniques- Rateb Jabbara*, Khalifa Al-Khalifaa,b, Mohamed Kharbechea, Wael Alhajyaseena, Mohsen Jafaric, Shan Jiangc (2018) [8]

Through many different methods, the detection of sleepiness has improved. One is based on driving patterns, influenced by vehicle characteristics, road conditions, and driving style. This has a correlation with a success rate of 86% from micro adjustments that would lead to drowsiness. The other is through physiological sensor data: EEG, ECG, and signals from the EEG that are used in determining the driver's drowsiness. Among the above methods, the most accurate is EEG, which has an accuracy of over 90%. However, this method is invasive and may be uncomfortable for the driver. The third method is computer vision, based on facial

feature extraction, which uses behaviours such as gaze, yawning duration, head movement, and eye closure. The fourth approach uses deep learning methods, particularly CNNs, to solve complex classification problems. Dwivedi et al. reached 78% accuracy with shallow CNNs. Park et al. designed a new architecture comprising three networks that consisted of Alex Net with three Fully-Connected layers and five CNNs to get features from images.

A WPCA-based method for detecting fatigue driving from EEG-based Internet of Vehicles system- NADONG, YINGJIE LI , ZHONGKE GAO, WAI HUNG IP2 and KAI LEUNG YUNG (2016) [9]

A proposed EEG-based IoV traffic management system was to improve traffic safety. To reduce the dimension of EEG signals for the real-time requirement of the purposed feature reduction method, we developed a novel WPCA algorithm. To verify the algorithm, we carried out a simulated driving experiment involving eight subjects. The comparison 3rd, 4th, and 5th order AR models, PSD, and DE was utilized as a feature extractor. Based on the features' different importances in the recognition process, the weights are determined. Then SVM was applied as a classifier. Introducing the classification evaluation indicators such as accuracy, sensitivity, and specificity. The proposed feature extractors - three experimental methods, including SVM, PCA-SVM, and WPCA-SVM were also designed simultaneously for each one of them. Based on the experiments, when extracting features with a 4th order AR model, classification results for all the 8 subjects can achieve their highest accuracy; for all these SVM, PCA-SVM, and WPCA-SVM approaches, the proposed method, WPCA-SVM achieved better performance when considering feature extraction methods. Overall, the algorithm reduced all data by a huge amount, and then significantly improved the classification accuracy that required more suitable big data processing.

This method can be effectively applied to EEG-based IoV traffic management systems, which meet real- time requirements. The future work will be to optimize the above technologies and study the real-time driving fatigue detection system.

Driver Drowsiness Detection System and Techniques- Vandna Saini and Rekha Sani (2014) [10]

This paper analyse the monitoring pupil movement, head position, and voice recognition to detect driver fatigue. Techniques to detect drowsiness are ECG and EEG, LBP (Local Binary Pattern), Steering Wheel Movement (SWM), and optical detection. ECG and EEG are physiological signals to detect drowsiness, which changes heart rate during different stages of drowsiness. The frequency bands in EEG signals include delta, theta, alpha, and beta. Power change

in the alpha frequency band would decrease, whereas the theta frequency band would be increased, reflecting drowsiness. LBP is a technique that summarizes an image's local structures efficiently based on the idea of comparing any pixel with those of its neighbourhoods; it is utilized for facial emotional expression detection or happiness, sad, and excitation. LBP is used in drowsiness detection by dividing the image into four quadrants and detecting the top and bottom parts. Small SWMs can determine the driver's drowsiness state and provide an alert if needed.

CONCLUSION

This research explore innovative ways of detecting and preventing drive drowsiness, making roads safer. These modern detection systems use sensors, cameras, and wearable devices in real-time monitoring of drivers, who will receive alerts when they exhibit signs of fatigue. "Smart Glasses" a are quite effective and work through eye-blink sensors that detect fatigue. Other systems include face and eye tracking and hand pressure monitoring for better detection. The EEG signals can potentially be used for detecting fatigue with high accuracy. Future improvements can include better machine learning methods that will make these systems more accurate, adaptable, and widely usable.

Future Scope

- Advanced Sensing Capabilities
- Artificial Intelligence and Machine Learning
- Enhanced Communication
- User-Friendly Design
- Environmental Adaptability
- Advanced Feedback Systems

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